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ABSTRACT

Between 1966 and 1975, 100,000 scientists and engineers emigrated to the U.S. Of these, 62,000 entered as permanent immigrants and the remainder as temporary visitors, subsequently changing their status to become permanent immigrants. This report summarizes the trends of scientist and engineer (S/E) immigration of the 1966-75 time period and relates these trends to economic factors. The data indicate there has been two distinct patterns of immigration; between 1966 and 1972 immigrants came at the rate of about 11,500 per year, while in the 1973-1975 period, the inflow was 6,500 yearly. Reasons for the immigrants coming to the U.S., impact of immigration policies, and data regarding continents of origin and occupational fields are discussed. Data on foreign students in the U.S. are included. (RH)

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Reviews OF DATA ON SCIENCE RESOURCES

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. NSF 77-305 No. 28, February 1977

Scientists and Engineers From Abroad: Trends of the Past Decade, 1966-75

Introduction and Summary

Between 1966 and 1975, 100,000 scientists and engineers emigrated to the United States.[1] Of these, 62,000 entered as permanent immigrants and the remainder as temporary visitors, subsequently changing their status to become permanent immigrants (table 1).

This report summarizes the trends of scientist and engineer (S/E) immigration of the 1966-75 period[2] and relates these trends to economic factors. It should be noted, however, that data on the work activities of immigrants after they enter are not maintained, and there is not necessarily a relationship between the immigrants' previous occupation and the one they pursue once here, except for those who enter specifically because of their occupation.

The data indicate that there have been two distinct patterns of S/E immigration in the 1966-75 decade (although the yearly flow of all immigrants has not varied greatly). Between 1966 and 1972, S/E immigrants came at an average rate of 11,500 per year, while in the 1973-75 period, the inflow was 6,500 yearly.

The response of immigration regulations to S/E labor market conditions has not been immediate. During the period in which engineers were still accorded occupational preference the U.S. labor market weakened considerably for engineers, with their unemployment rate rising from 0.8 percent to 2.9 percent between 1969 and 1971. In spite of the rising unemployment (and unmeasured underemployment) the annual inflow of engineers rose from 7,200 in 1969 to 9,300 in 1970 and 9,000 in 1971. Only in 1972 did the flow of immigrants begin to decline, as a result of changes in certification practices.

A number of factors influence the decision to immigrate to this country and emigrate from other nations. In a survey made by the National Science

TABLE 1.—SUMMARY OF ANNUAL FLOWS OF SCIENTISTS AND ENGINEERS FROM ABROAD: 1966-75

Period[1]	Total entrants	Immigrants			Non-immigrants[2]
		Total	Direct	Change of status	
	In thousands				
Total:					
1966-75	N.A.	100.3	61.6	38.6	N.A.
1966-72	N.A.	80.7	49.0	31.8	N.A.
1973-75	N.A.	19.5	12.6	6.9	N.A.
Average annual entrants:					
1966-75	15.1	10.0	6.2	3.9	5.0
1966-72	16.4	11.5	7.0	4.5	4.8
1973-75	12.0	6.5	4.2	2.3	5.5
	Percent				
Comparison of average annual entrants:					
1973-75 ÷ 1966-72	73	57	60	51	115

[1] Fiscal years ending June of years shown.
[2] Excludes persons entering under student visas.
NOTE: N.A.—Data are not applicable since they are not additive. Average annual entrants are shown for comparative purposes only.
Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

[1] While these immigrants were scientists or engineers in the countries from which they came, they are not necessarily employed as such in the United States.

[2] Years refer to fiscal years ending in June.

(Prepared in the Manpower Utilization Studies Group, Division of Science Resources Studies.)

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Foundation (NSF) in 1970 immigrants primarily cited economic factors for being attracted to the United States. One-half of those who immigrated here increased their annual income by more than 200 percent above the salary last received in the country from which they emigrated. In some instances an incentive to emigrate was also present, such as a hostile political environment or insufficient opportunities to do research.[3]

Other studies which have examined the combination of the pushes and pulls which influence international migration confirm that the desire to emigrate is a strong incentive. This, combined with the generally greater real income and strong demand here for scientists and engineers during the sixties, led to the surge of immigrants which did not slow down until limited by regulation. The initial surge of the 1967-68 period reflects, for the most part, students and other temporary immigrants becoming permanent immigrants as the country quotas of the earlier immigration law were revised. In fact, because such a significant share of the foreign scientists and engineers were already studying or working in the United States before becoming permanent immigrants, the decision facing them was whether to return to their homelands rather than assessing the relative advantages of migrating. Additionally, some of the scientists and engineers who immigrate directly from another country have previously studied here. The magnitude of this flow, however, is not known.

Impacts of Immigration Policies

Two major changes in the laws and regulations surrounding immigration to the United States have taken place since the midsixties. The first, in 1965, eliminated the preferential treatment of immigrants from northern European nations and established a system giving precedence to immediate relatives and offspring of U.S. citizens or noncitizens residing permanently in the United States. A high priority also was given to persons in occupations which were in short supply in this country. These precedence changes affected the proportions of immigrants from various countries. For example, in 1966, before the 1965 Act became fully effective, nearly 40 percent of the immigrant scientists and engineers came from northwestern European countries and 28 percent came from Asia. (In 1966, these areas contributed 17 percent and 12 percent, respectively, of all immigrants). By 1970, 19 percent of the scientists and engineers came from northwestern Europe and 56 percent from Asia (compared with 9 percent and 24 percent, respectively, of all immigrants). (See chart and table 2.)

The second major change eliminated scientists and engineers from the category of shortage occupations. This change occurred in the midst of relatively high unemployment rates for scientists and engineers in the United States. By 1973 this action resulted in a precipitous decline in the number of permanent immigrant scientists and engineers. The total number

[3] National Science Foundation, *Immigrant Scientists and Engineers in the United States: A Study of Characteristics and Attitudes* (NSF 73-302) (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1973.)

TABLE 2.—IMMIGRANT SCIENTISTS AND ENGINEERS BY CONTINENT OF LAST PERMANENT RESIDENCE: FY 1966-75[1]
[In thousands]

Region	Total	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
						Permanent immigrants					
Total	100.2	7.2	12.5	13.0	10.3	13.3	13.1	11.3	6.6	6.0	6.9
Europe	25.7	2.9	4.5	5.0	2.6	2.8	2.0	1.7	1.3	1.3	1.6
Asia	50.7	2.0	4.7	4.0	4.9	7.5	8.7	7.6	3.9	3.4	4.0
Africa	4.0	1	2	4	6	1.0	5	4	3	2	3
South America	3.5	4	5	6	4	3	4	3	2	2	2
North and Central America	15.1	1.7	2.5	2.9	1.6	1.6	1.4	1.2	8	7	7
Other	1.3	1	2	2	1	2	1	1	1	1	1
						Temporary immigrants					
Total	47.5	5.5	5.4	5.6	5.4	6.6	2.4	2.7	4.1	4.9	5.5
Europe	20.5	2.3	2.5	2.6	2.4	2.7	1.1	9	1.7	1.8	2.5
Asia	11.5	1.5	1.4	1.6	1.3	1.3	4	9	1.0	1.2	1.1
Africa	1.8	3	2	2	2	2	1	1	2	2	2
South America	4.4	5	4	4	5	7	2	3	4	5	5
North and Central America	7.7	7	7	7	8	1.0	4	4	7	1.1	1.1
Other	1.6	2	2	2	2	2	1	1	1	2	2

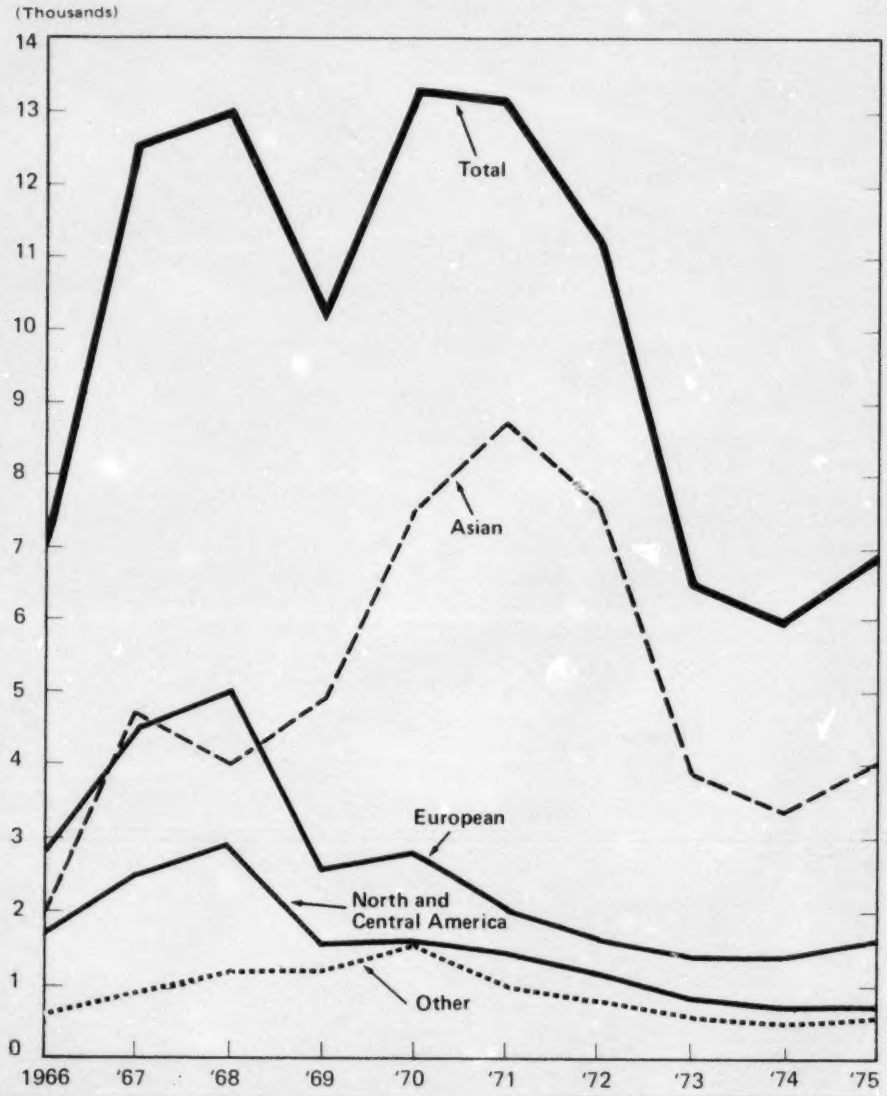
[1] While these data represent last permanent residencies, permanent immigrant visas are granted on the basis of the country of birth. The resultant pattern of immigration, however, is not significantly different if counted by country of birth.

Note: detail may not add to total because of rounding.

Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

of scientists and engineers, however, (including temporary visitors) did not decline as much because of increases in the number of nonimmigrants and intracompany transferees entering the United States. For example, in 1972 fewer than 3,000 scientists and engineers came with temporary visas, including about 200 intracompany transferees. In 1975, more than 5,500 came, including almost 1,300 intracompany transferees. (Foreign scientists and engineers still enter under other immigration preferences such as those mentioned previously and as displaced persons or refugees from oppressive governments.)

Immigrant scientists and engineers by continent of last permanent residence: FY 1966-75



Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

Immigration Comparisons

WORLD'S SCIENTISTS AND ENGINEERS

When compared with estimates of the available resources of scientists and engineers throughout the world, immigrants to this country have come disproportionately from other North and Central American[4] and Caribbean countries and from Asia than from the rest of the world.[5]

Between 1966 and 1971 one-half of the immigrant scientists and engineers came from Asian countries, while these countries, in the midsixties, had about one-eighth of the world's S/E labor force.[6] The incompatibility and gaps of data from one nation to another makes estimates of the manpower resources in various parts of the world subject to margins of uncertainty. Therefore, in this report, these resources are discussed in terms of a relative order of magnitude. On the other hand, the European nations (including the U.S.S.R.), which employed about three-fourths of the scientists and engineers in the world, supplied only about one-fourth of the immigrant scientists and engineers.

ALL IMMIGRANTS

In the 1966-75 decade, scientists and engineers represented 2.6 percent of all immigrants and 6 percent of those who were destined to enter the U.S. labor force. (About one-half of all immigrants were housewives and children). By comparison, scientists and engineers comprised about 2 percent of total U.S. employment during the same period. The scientists and engineers from Africa and Asia accounted for 6.8 percent and 5.4 percent of total immigration from their respective continents. On the other hand, scientists and engineers represented about 1 percent of all immigration from other North American nations, whose emigrants to the United States were dominated by farm workers (table 3).

Some likely reasons for this relatively high rate of S/E immigration were the overseas recruiting by large companies to fill shortages in the sixties, and the educating of foreigners, mainly from less developed countries, in U.S. colleges and universities. Many of these students from African and Asian countries remained to work and become U.S. citizens. Also, it is likely that the scientists and engineers were among the highest income groups in their home country, thereby being better able to afford the costly migration to the United States than others with less resources.

TABLE 3.—IMMIGRANT SCIENTISTS AND ENGINEERS COMPARED WITH TOTAL IMMIGRANTS BY AREA: FY 1966-75

Area	In thousands		Percent scientists/engineers of total immigration
	Total immigration[1]	Scientist/engineer immigration[2]	
All areas	3,808	100.2	2.6
Europe	1,067	25.7	2.4
Asia	944	50.7	5.4
Africa	59	4.0	6.8
South America	216	3.5	1.6
North and Central America	1,492	15.1	1.0
Other	28	1.3	4.6

[1] By country of birth.

[2] By country of last permanent residence. The reason is that they represented resources of these countries, not resources of their countries birth.

Note: Detail may not add to totals because of rounding.

Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

SCIENTISTS VERSUS ENGINEERS

Of the 100,000 immigrant scientists and engineers in the 1966-75 decade, about 31,000 were scientists and 69,000 were engineers. In the 1966-71 period, however, proportionately fewer scientists than engineers immigrated. In this period scientists comprised 30 percent of the 69,000 immigrants, while in the 1972-75 period scientists accounted for 34 percent of the 31,000 immigrants. These patterns reflect the relative ebbs and flows of demand for the services of these workers (table 4).

Although the total number of S/E immigrants and the proportion of all scientists and engineers to the total did not experience major changes when 1966 is compared with 1974 and 1975, the component occupations of scientists and engineers have changed. For example, among the scientists the numbers and proportions of agricultural and social scientists have risen while physical and mathematical scientists fell from 1966 to the later years. Among the engineers, chemical, civil, and mechanical engineers grew in numbers and shares, while aeronautical engineers fell considerably. Table 5 details these data.

[4] This includes Canada, which, in part, has served as an intermediate residence for immigration to the United States.

[5] Excluded are mainland China and Australia and New Zealand from the Asian and world totals.

[6] Excluding the United States, Oceania, and mainland China. Derived from estimates appearing in Organisation for Economic Co-operation and Development, *Statistics of the Occupational Structure of the Labor Force in 53 Countries*. (Paris, 1969.)

TABLE 4.—PATTERNS OF SCIENTIST AND ENGINEER IMMIGRATION: FY 1966-75
[Numbers in thousands]

Year	Total number	Percent	Scientists		Engineers		Scientists & engineers as a percent of total immigration
			Number	Percent	Number	Percent	
1966	7.2	100.0	2.3	31.8	4.9	68.2	2.2
1967	12.5	100.0	3.7	29.6	8.8	70.4	3.5
1968	13.0	100.0	3.7	28.2	9.3	71.8	2.9
1969	10.3	100.0	3.1	30.3	7.2	69.7	2.9
1970	13.3	100.0	4.0	30.2	9.3	69.8	3.6
1971	13.1	100.0	4.1	31.4	9.0	68.6	3.5
1972	11.3	100.0	3.9	34.9	7.4	65.1	2.9
1973	6.6	100.0	2.2	33.1	4.4	66.9	1.7
1974	6.0	100.0	2.1	35.2	3.9	64.8	1.5
1975	6.9	100.0	2.3	33.1	4.7	66.9	1.8
			Cumulative				
1966-75	100.2	100.0	31.4	31.3	68.9	68.7	2.6
1966-71	69.4	100.0	20.9	30.1	48.2	69.9	3.1
1972-75	30.9	100.0	10.5	34.0	20.4	66.0	2.0

Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

TABLE 5.—DETAILED OCCUPATIONS OF PERMANENT IMMIGRANT SCIENTISTS AND ENGINEERS: FY 1966, 1974, AND 1975

Field	1966	Percent	1974	Percent	1975	Percent
Total scientists and engineers	7,205	100.0	5,969	100.0	6,931	100.0
Scientists, total	2,290	31.8	2,103	35.2	2,283	32.9
Agricultural scientists[1]	185	2.6	250	4.2	305	4.4
Biological scientists	227	3.2	222	3.7	238	3.4
Mathematical scientists[2]	176	2.4	161	2.7	102	1.5
Physicists	315	4.4	113	1.9	137	2.0
Chemists	874	12.1	592	9.9	675	9.7
Geologists[3]	98	1.4	67	1.1	71	1.0
Other natural scientists	74	1.0	80	1.3	74	1.1
Economists	164	2.3	268	4.5	346	5.0
Psychologists	97	1.3	189	3.2	126	1.8
Other social scientists	80	1.1	161	2.7	209	3.0
Engineers, total	4,915	68.2	3,866	64.8	4,648	67.1
Aeronautical	241	3.3	24	4	40	6
Chemical	325	4.5	333	5.6	438	6.3
Civil	489	6.8	575	9.6	694	10.0
Electrical	680	9.4	543	9.1	676	9.8
Industrial	169	2.3	164	2.7	189	2.7
Mechanical	577	8.0	627	10.5	845	12.2
Other[4]	2,434	33.8	1,600	26.8	1,766	25.5

[1] Includes foresters and conservationists.
[2] Includes mathematicians, statisticians, actuaries, operations researchers and systems analysts.
[3] Includes geophysicists.
[4] Includes those who classified themselves as engineers, giving no specialty, as well as mining, petroleum, sales and metallurgical engineers.
Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

In 1974 the pattern of immigrant scientists and engineers roughly coincided with the distribution of employment in the United States. There were, however, some variations. For example, relatively more agricultural scientists, chemists, and mathematical scientists immigrated than were employed, and fewer other scientists (primarily medical scientists), geologists, physicists, and biological scientists came from abroad (See Introduction and table 6.)

TABLE 6.—COMPARISON OF IMMIGRANT SCIENTISTS AND ENGINEERS TO U.S. SCIENCE AND ENGINEERING EMPLOYMENT: 1974[1]
[Percent distribution]

Field	Immigrants[2]	U.S. employment
Total	100.0	100.0
Engineers	72.2	69.9
Scientists	27.8	30.1
Chemists	11.1	8.4
Physicists	2.1	3.0
Geologists[3]	1.3	2.0
Mathematical scientists[4]	3.0	2.5
Agricultural scientists	4.7	3.0
Biological scientists	4.1	4.8
Other scientists	1.5	6.4

[1] Excludes social scientists and psychologists.
[2] Stated occupation at time of entry.
[3] Includes geophysicists.
[4] Includes mathematicians, statisticians, actuaries, operations researchers and systems analysts.
Sources: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice and U.S. Bureau of Labor Statistics, Department of Labor.

Foreign Students in the United States[7]

Because a significant number of persons who come to this country as college students opt to become immigrants, it is relevant to summarize the patterns of foreign student enrollment of the past decade. In these years (1966-75) an annual average of about 135,000 foreign students were enrolled in U.S. colleges and universities. Between 40 percent and 50 percent of these students were studying science and engineering. In the latter part of the period more than 80 percent of all foreign students in the United States were from the less developed regions of the world—Asia, Africa, and Latin America (one-half being from Asia) (table 7).

Between 1966 and 1975 about 27,000 of these students became immigrant scientists and engineers. About 12,000 changed from temporary student visas to permanent immigrant visas from 1970 to 1972. Subsequently, from 1973 to 1975, an average of 1,350 per year made this change. These former students represent about one-fourth of the immigrant scientists and engineers in the decade. The students who chose to remain, however, represent a small portion of the individuals who came here to study.

[7] Data in this section are derived from Institute for International Educational Exchange, *Open Doors*, various editions. (New York: Institute for International Educational Exchange.)

TABLE 7.—NONIMMIGRANT STUDENTS OF SCIENCE AND ENGINEERING WHO BECAME PERMANENT IMMIGRANTS, BY FISCAL YEAR OF ENTRY AND REGION OF BIRTH: 1966-75

Fiscal year of entry	All regions	Europe	Asia	North and Central America	South America	Africa	Other
Total	27,120	1,727	24,478	21	12	773	106
1966	1,660	168	1,450	1	7	28	6
1967	3,823	213	3,534	2	4	57	13
1968	2,855	229	2,538	2	0	75	11
1969	2,691	176	2,443	0	1	62	9
1970	4,100	258	3,701	2	0	124	15
1971	4,284	192	3,951	3	0	127	11
1972	3,649	197	3,316	2	0	120	14
1973	1,183	89	1,025	6	0	51	12
1974	1,282	98	1,117	2	0	56	9
1975	1,593	110	1,403	1	0	73	6

Source: National Science Foundation based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

Note

During the 1966-75 period, permanent immigrants from Eastern Hemisphere nations entered the United States under eight types of categories issued according to the preference which they receive. The first, second, fourth, and fifth preference groups are reserved for relatives of U.S. citizens or aliens who reside here permanently. The third and sixth preferences are reserved for persons in shortage occupations, the third for professional workers, their spouses and children, and the sixth for other workers, their spouses and children. The seventh and final preference is reserved for certain refugees from religious, political, and racial persecution who enter on a conditional basis, and who in two years, may become permanent immigrants. Lastly, there are the nonpreference immigrants who take, on a first-come, first-served basis, the portion of each year's quota which has not been used by the preferenced immigrants.

Western Hemisphere immigration to the United States after fiscal year 1968 proceeded on a first-come, first-served basis, up to a maximum of 120,000 annually; and without regard to a preference system. Previously, Western Hemisphere immigration was not numerically restricted. Commencing in 1977, however, immigration from these countries was subject to a similar quota system as the immigration from the rest of the world.

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